

High Coefficient of Performance HgCdTe And Metallic Superlattice-Based Thermoelectric Coolers, Phase I

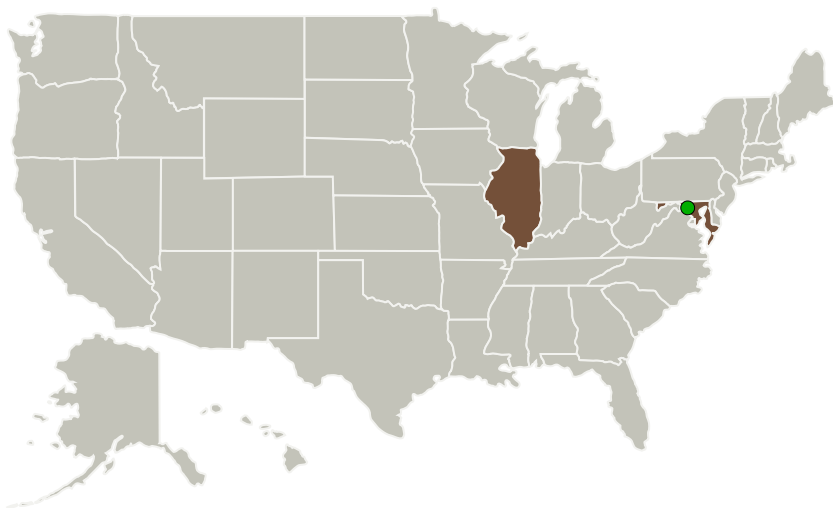
Completed Technology Project (2011 - 2011)



Project Introduction

We propose the development of nanoscale superlattices (SLs) as the active elements of high efficiency thermoelectric coolers. Recent models predict that the thermoelectric figure of merit ZT can reach 4 for elements fabricated from HgCdTe-based SLs and could exceed 6 for related metal/semiconductor SLs. The feasibility of using HgCdTe and metal-based SL materials with embedded nanodefects for increased hot-carrier transport during thermoelectric cooling will be demonstrated in the proposed Phase 1 effort. We will perform calculations to optimize the material parameters of HgCdTe- and metal-based SL structures to maximize ZT . Next, we will use our extensive experience in molecular beam epitaxy to grow the designed structures. Finally, we will develop device structures and metallization methods appropriate for performing ZT measurements, measure the ZT s of fabricated devices and compare results with theory.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
EPIR Technologies, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Bolingbrook, Illinois
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Illinois	Maryland
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Project Transitions

**February 2011:** Project Start**September 2011:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138191>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

EPIR Technologies, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

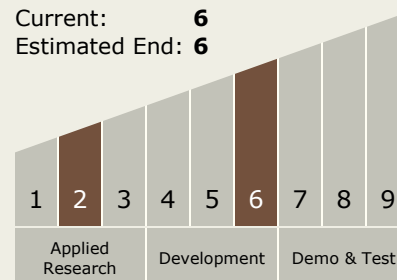
Carlos Torrez

Principal Investigator:

Silviu Velicu

Technology Maturity (TRL)

Start: 2
 Current: 6
 Estimated End: 6



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.1 Materials
 - └ TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System